

Preliminary Height Estimation of Small Spots on SCRF Cavity's Interior Surface by Reflection Angular Measurement

12/4/2007 tajima

We put Electro-Luminescence stripe sheets (ELs) around the camera cylinder (Fig.1).

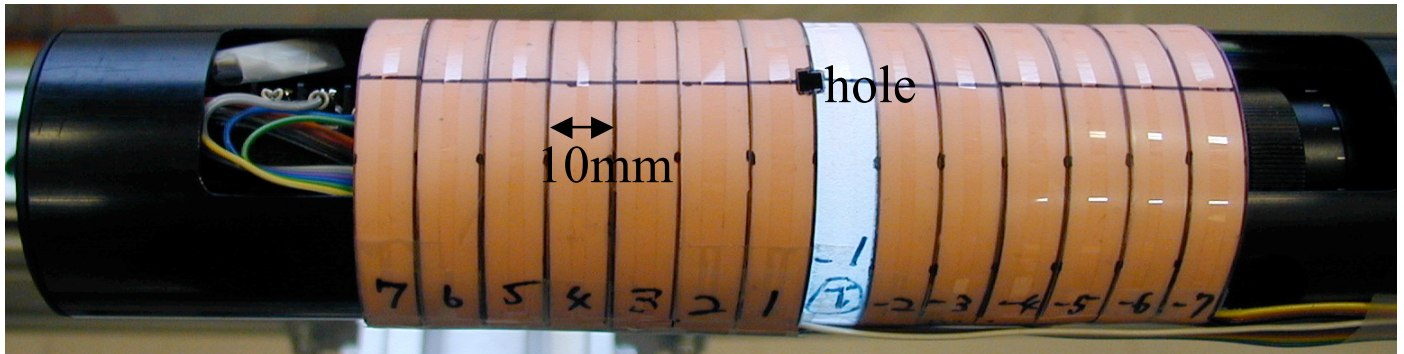


Fig.1: EL stripes. They are 10mm in axial directions and cover 100mm in azimuthal direction. These fourteen illuminations can be turned ON/OFF one by one. The mirror is installed under the center of the ELs on which a 4mm x 4mm hole is located. Only one stripe that is labeled as “-1” is turned ON in the figure.

Assuming that cavity's interior surface is a complete mirror, we can measure gradients of the cavity's interior surface with these ELs. The schematic drawing is shown in Fig.2.

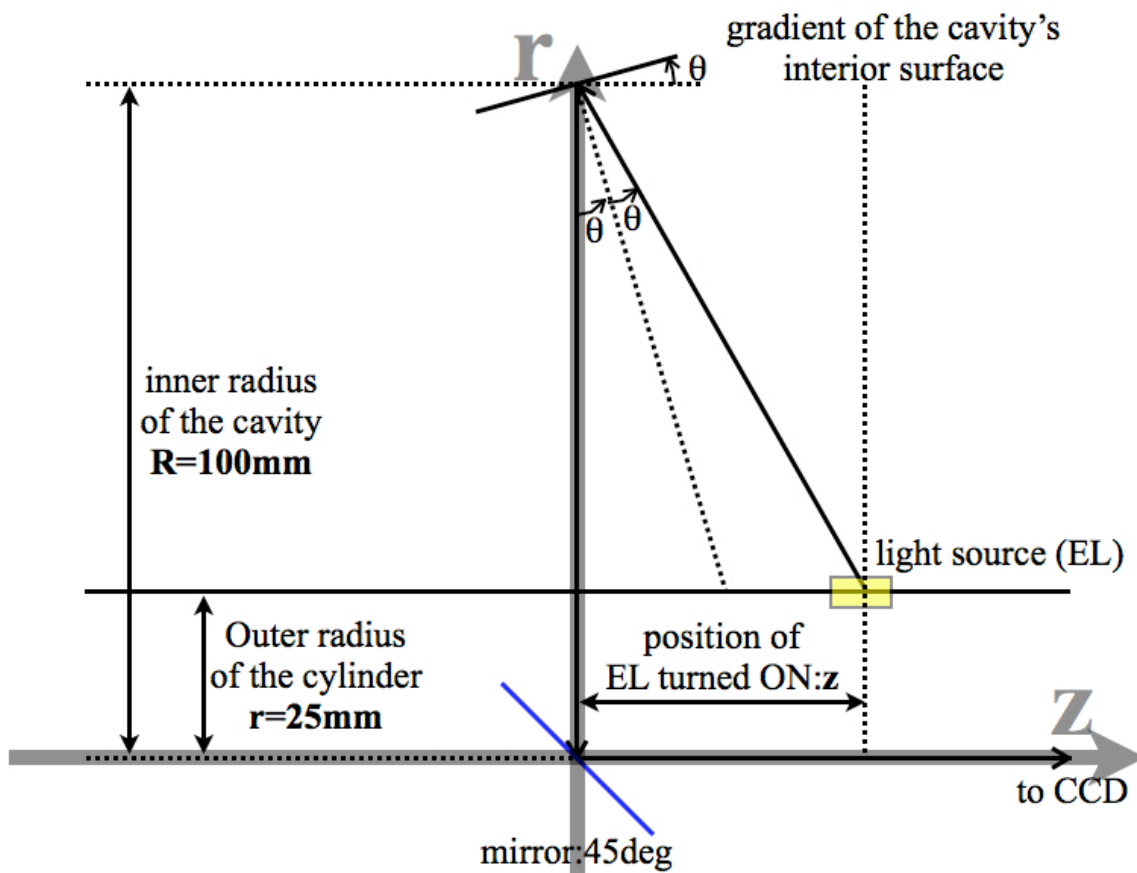


Fig.2: Schematic drawing of the measurement of gradients of the cavity's interior surface with the ELs. .

The reflection angle θ is given by,

$$\vartheta = \frac{1}{2} \arctan\left(\frac{z}{R-r}\right),$$

where z , R and r are the axial position of light source, the inner radius of the cavity and the outer radius of the cylinder, respectively. This relation between θ and z is shown in Fig.3.

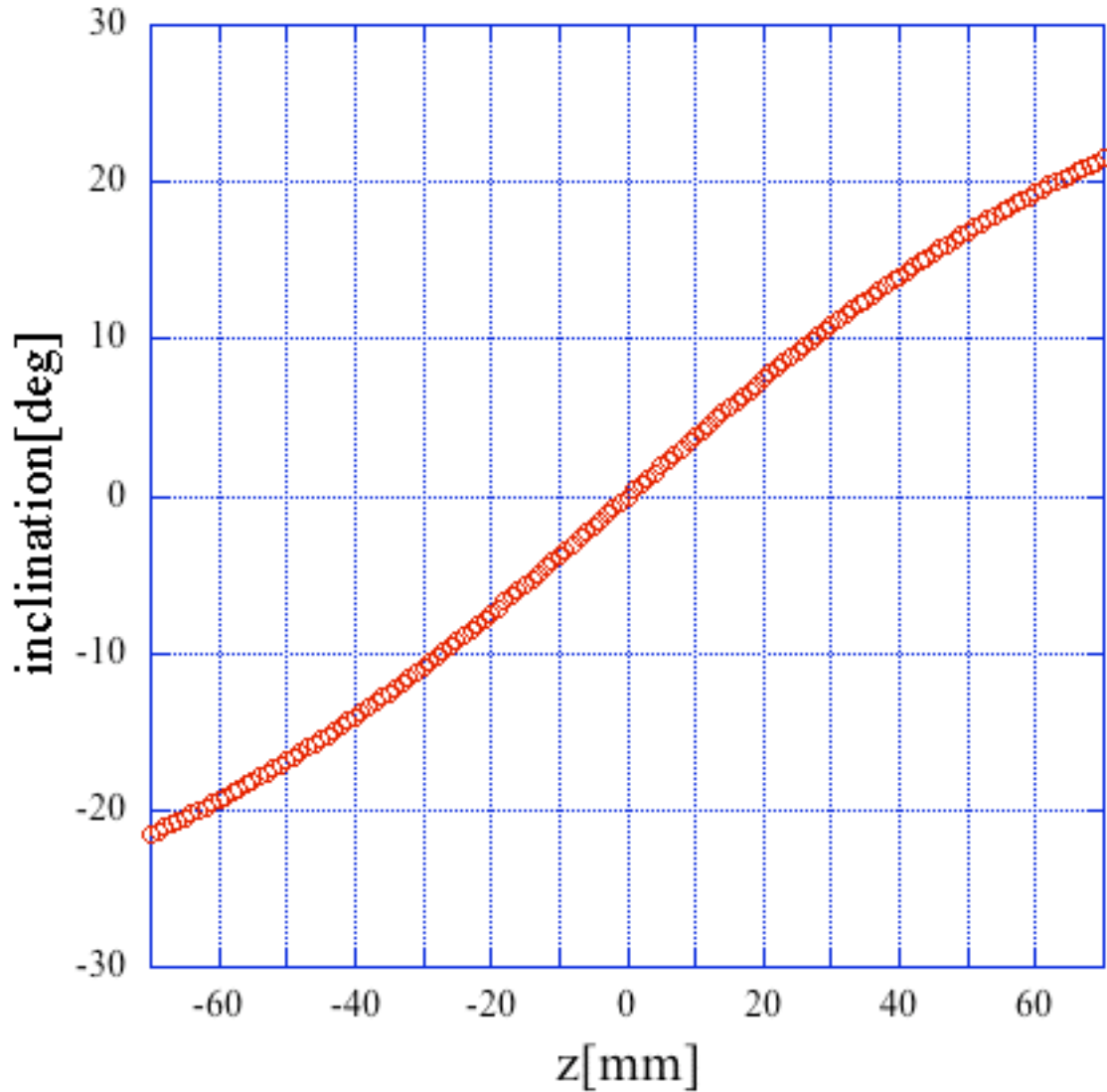


Fig.3: Relation between the gradients of the cavity's interior surface, θ , and the axial position of the EL turned ON, z . r is 25mm and R is 100mm.

We measured a spot shown in Fig.4 located on an equator EBW seam of the nine cell cavity . Turning ON the ELs one by one, we took the pictures shown in Fig.5.

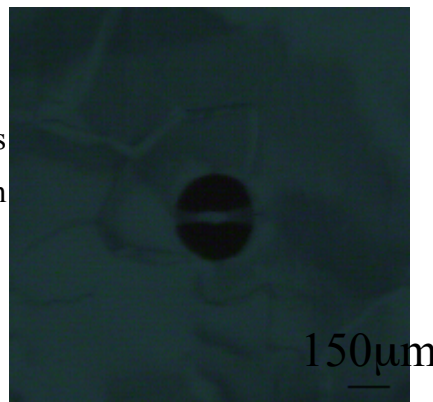
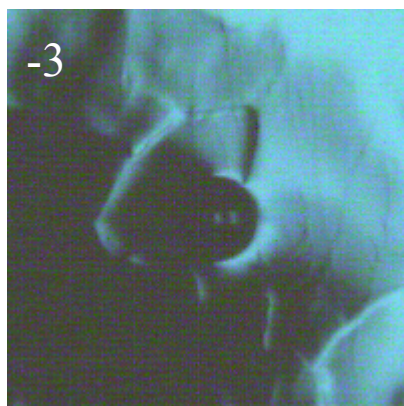
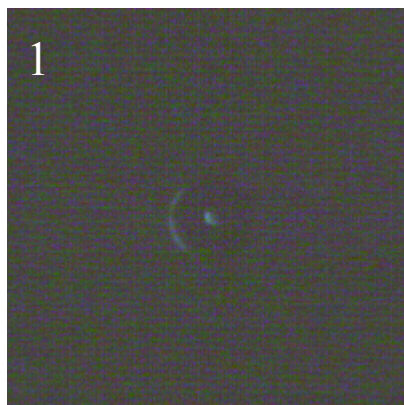
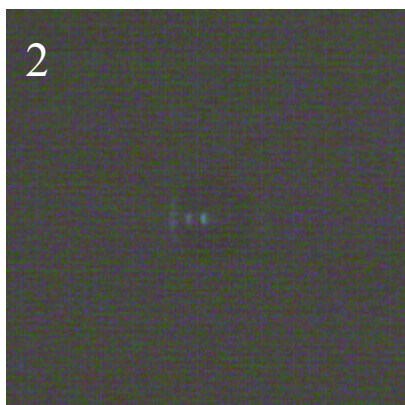
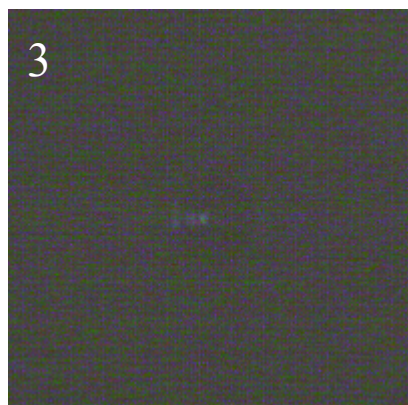
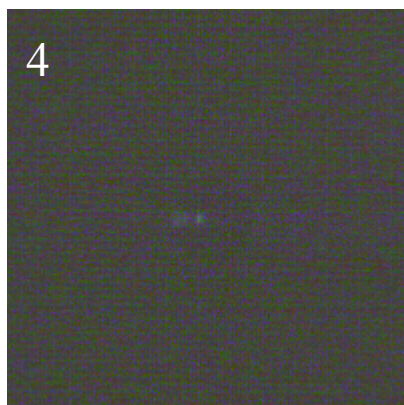
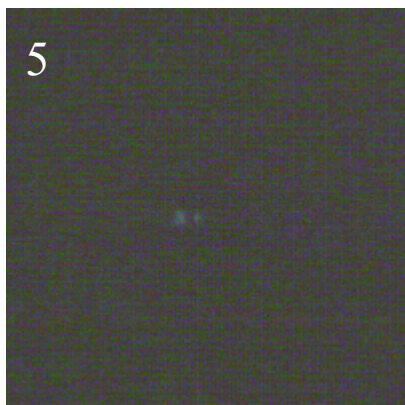
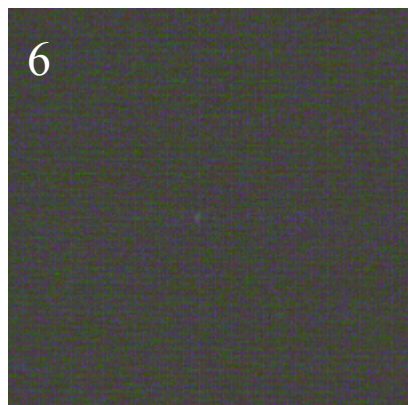
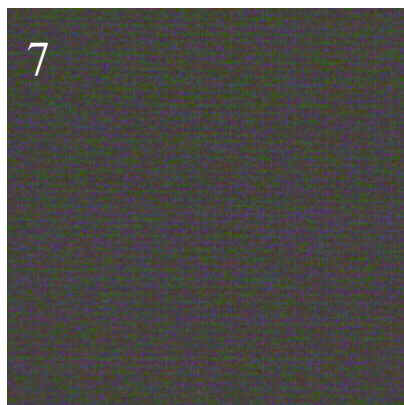


Fig.4: The measured spot. This picture was taken when the fourteen ELs were all turned ON.



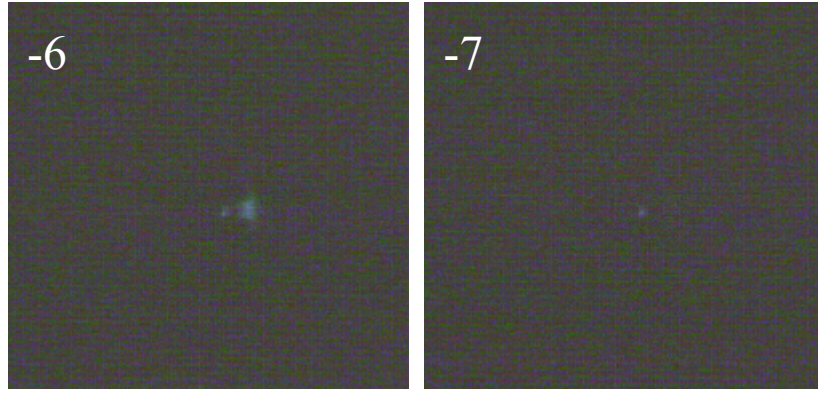


Fig.5: Fourteen pictures took by turning ON the ELs one by one. The numbers shown in each figures' upper left corners correspond to the EL turned ON shown in Fig.1.

The gradients of illuminated regions in each figure of Fig.5 correspond to the illuminator position. For example, in “-1” of Fig.5, because the position of illuminator is $0 < z < 10$ mm, the gradient of the illuminated region is $0 < \theta < 3.8$ degree (see Fig.3). We take the central value for the z-coordinate. The gradient of the illuminated regions in “-1” of Fig.5, are all estimated as 1.9 degree, from the value for $z = 5$ mm. Fig.6(a) shows the resulted gradients along a horizontal line indicated in Fig.6(b).

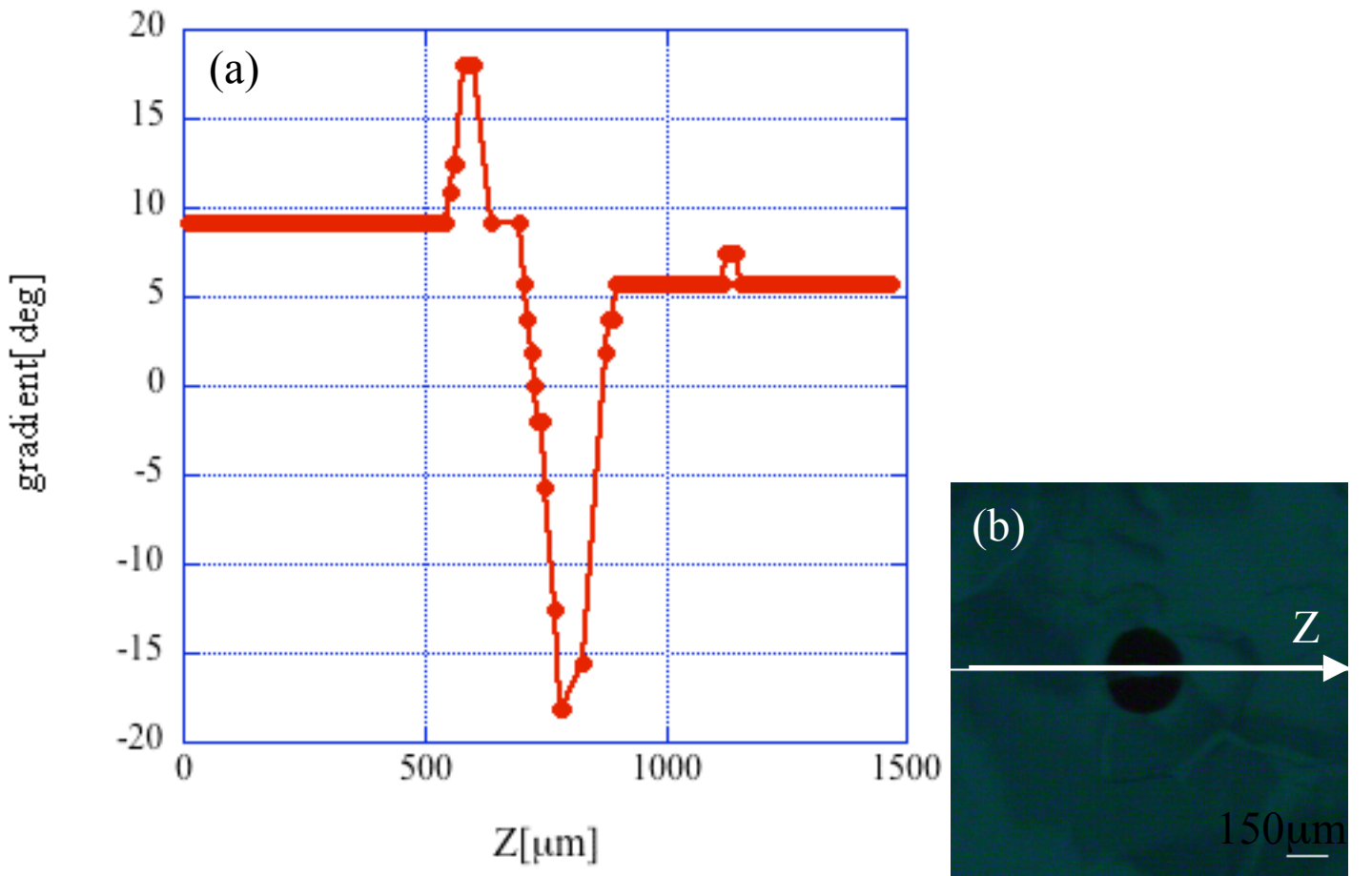


Fig.6: (a) the estimated gradients of the cavity's interior surface. (b) the gradients on the horizontal line was measured.

By integrating the gradients in Fig.6 (a), the height of the interior surface was calculated (Fig.7). Error estimation is necessary.

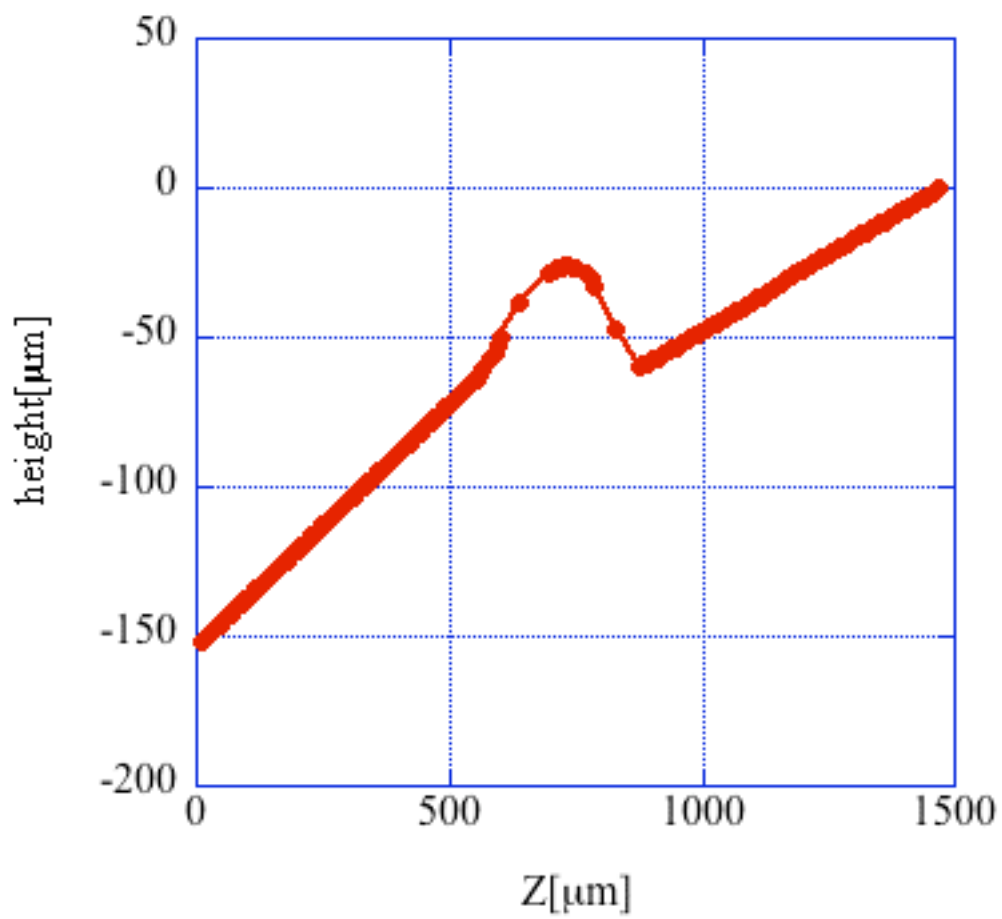


Fig.7: The height of the cavity's interior surface.